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Brink

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(45) **Date of Patent: Sep. 22, 2015**

(54) **LED LIGHTBULB**

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(22) Filed: **Oct. 23, 2013**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 14/041,315, filed on Sep. 30, 2013.

(51) **Int. Cl.**

F21V 23/00	(2015.01)
F21K 99/00	(2010.01)
F21S 8/10	(2006.01)
F21Y 101/02	(2006.01)
F21Y 111/00	(2006.01)

(52) **U.S. Cl.**

CPC ..... ***F21V 23/00*** (2013.01); ***F21K 9/00*** (2013.01);***F21K 9/13*** (2013.01); ***F21S 48/212*** (2013.01); *F21Y 2101/02* (2013.01); *F21Y 2111/001* (2013.01)

(58) **Field of Classification Search**

USPC 362/249.02, 249.06, 254

See application file for complete search history.

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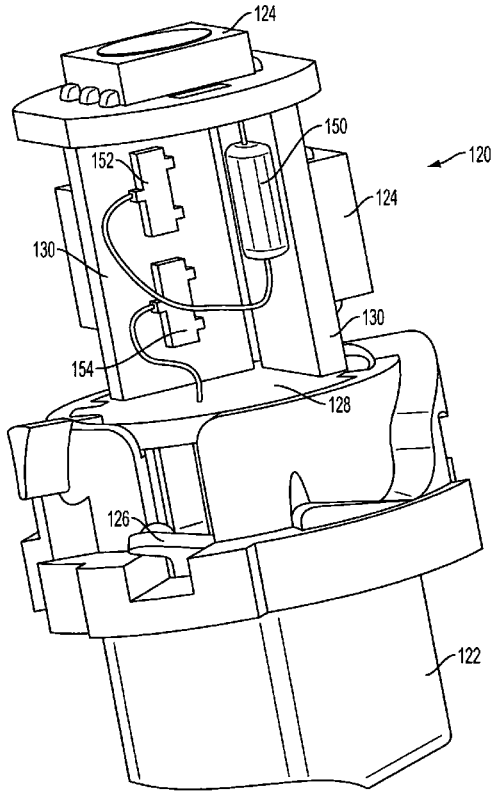
(57) **ABSTRACT**

An LED light bulb system that has a socket base and a contactor arranged in the socket base. The light bulb system also has a support circuit board secured to the socket base and a plurality of circuit boards connected to the support circuit board in a vertical direction. The light bulb also uses at least one resistor on each of the plurality of circuit boards to operate the LED.

16 Claims, 22 Drawing Sheets



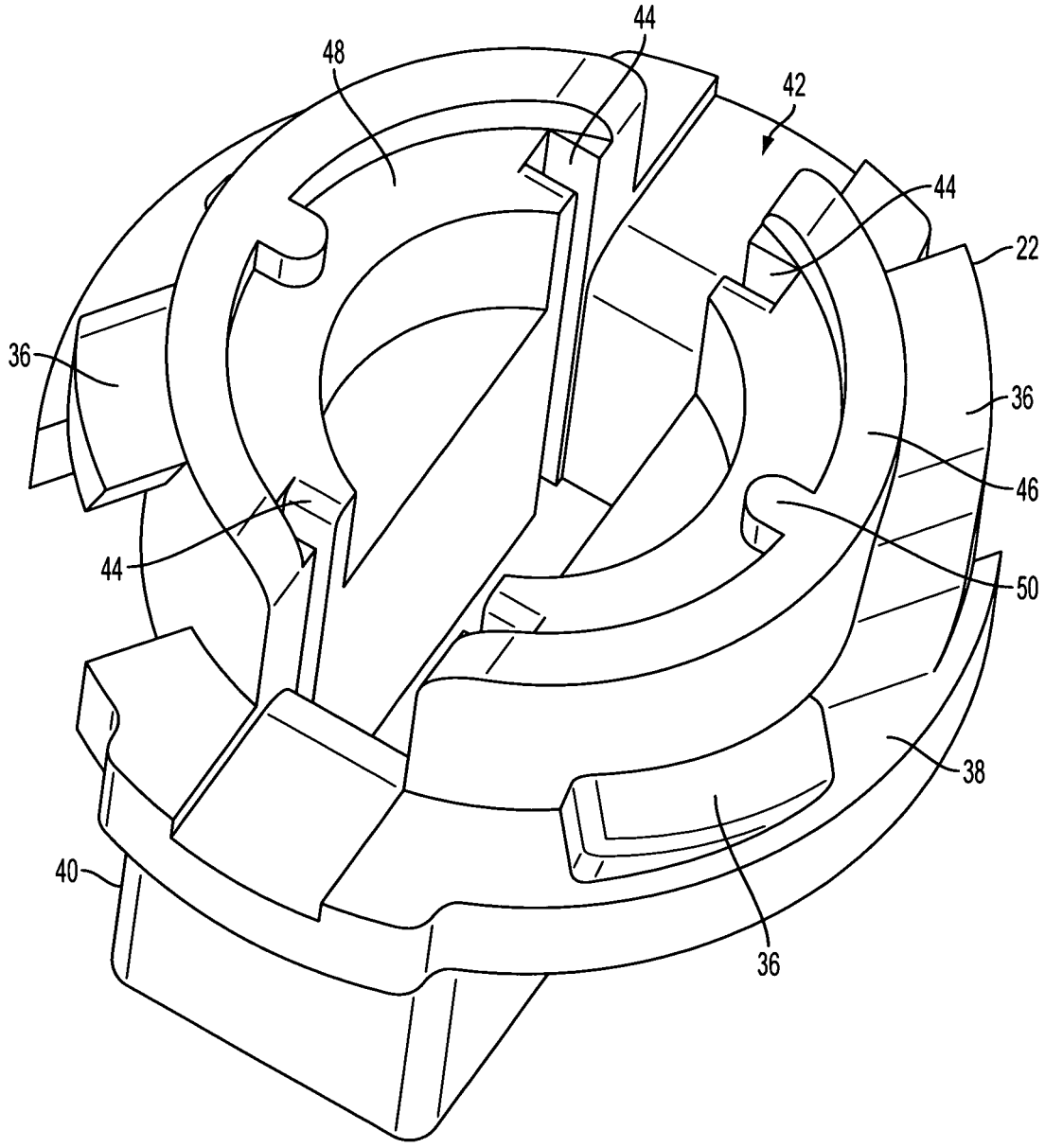


FIG. 1

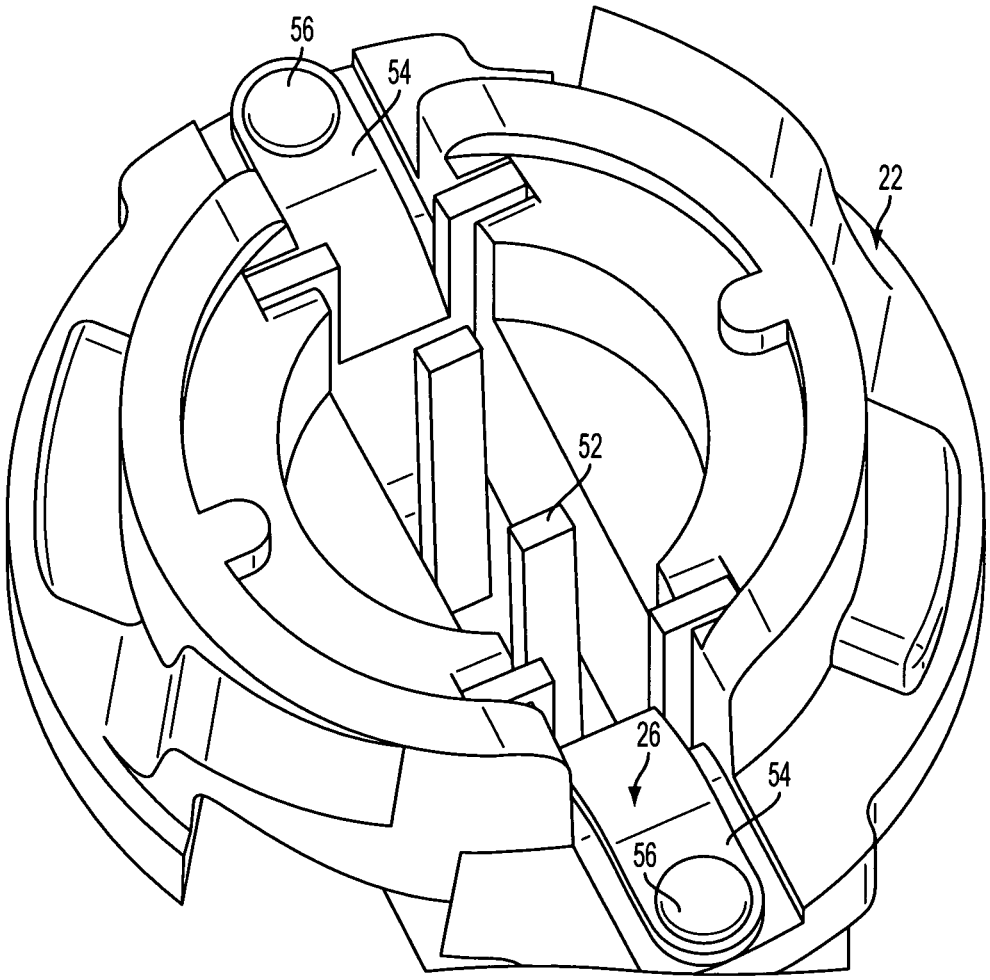


FIG. 2

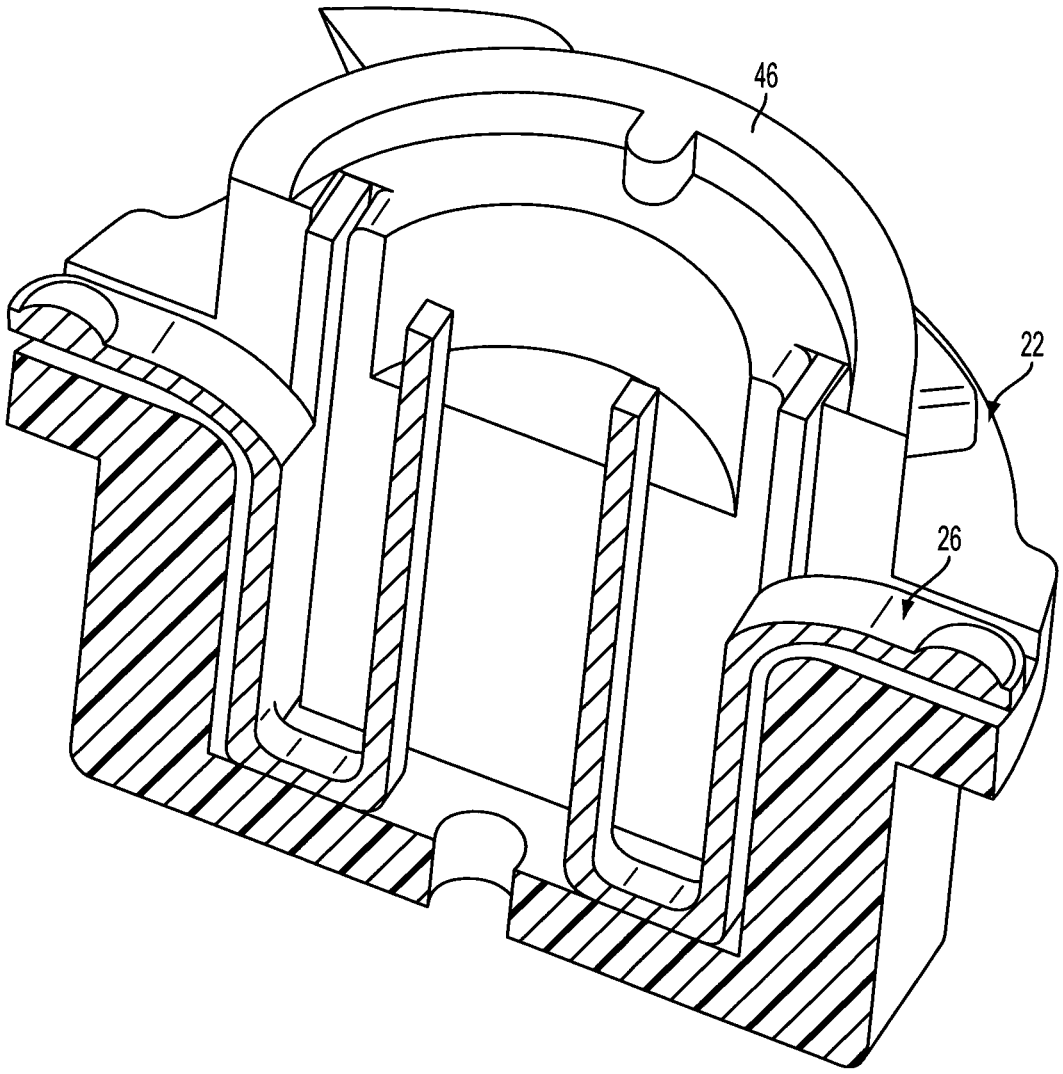


FIG. 3

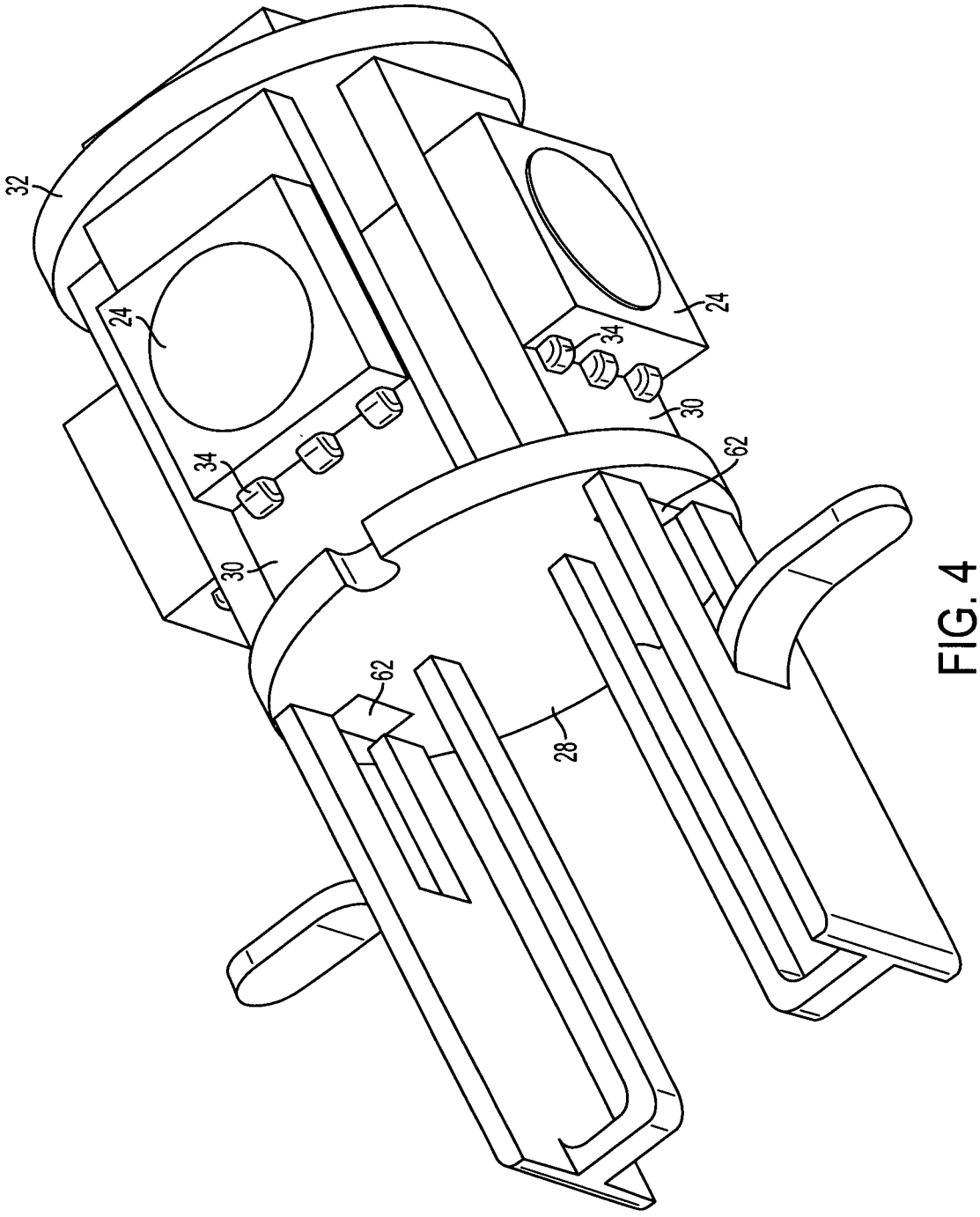


FIG. 4

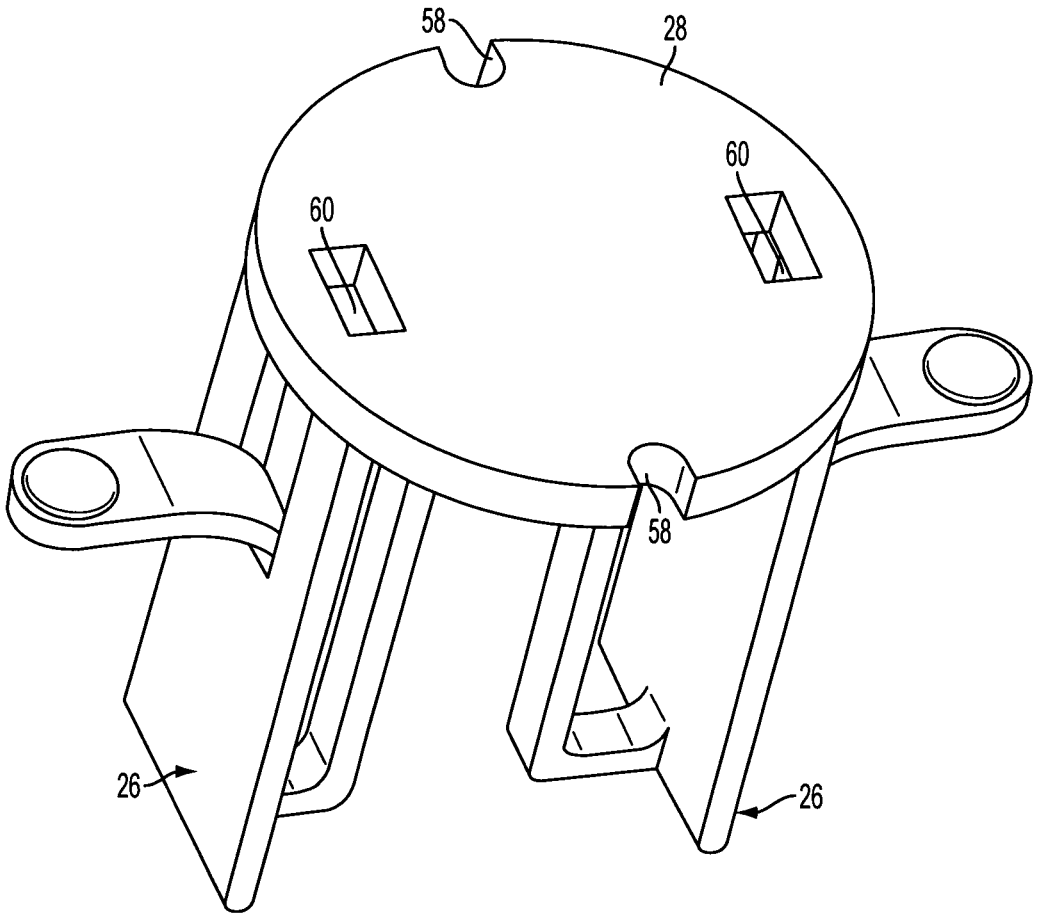


FIG. 5

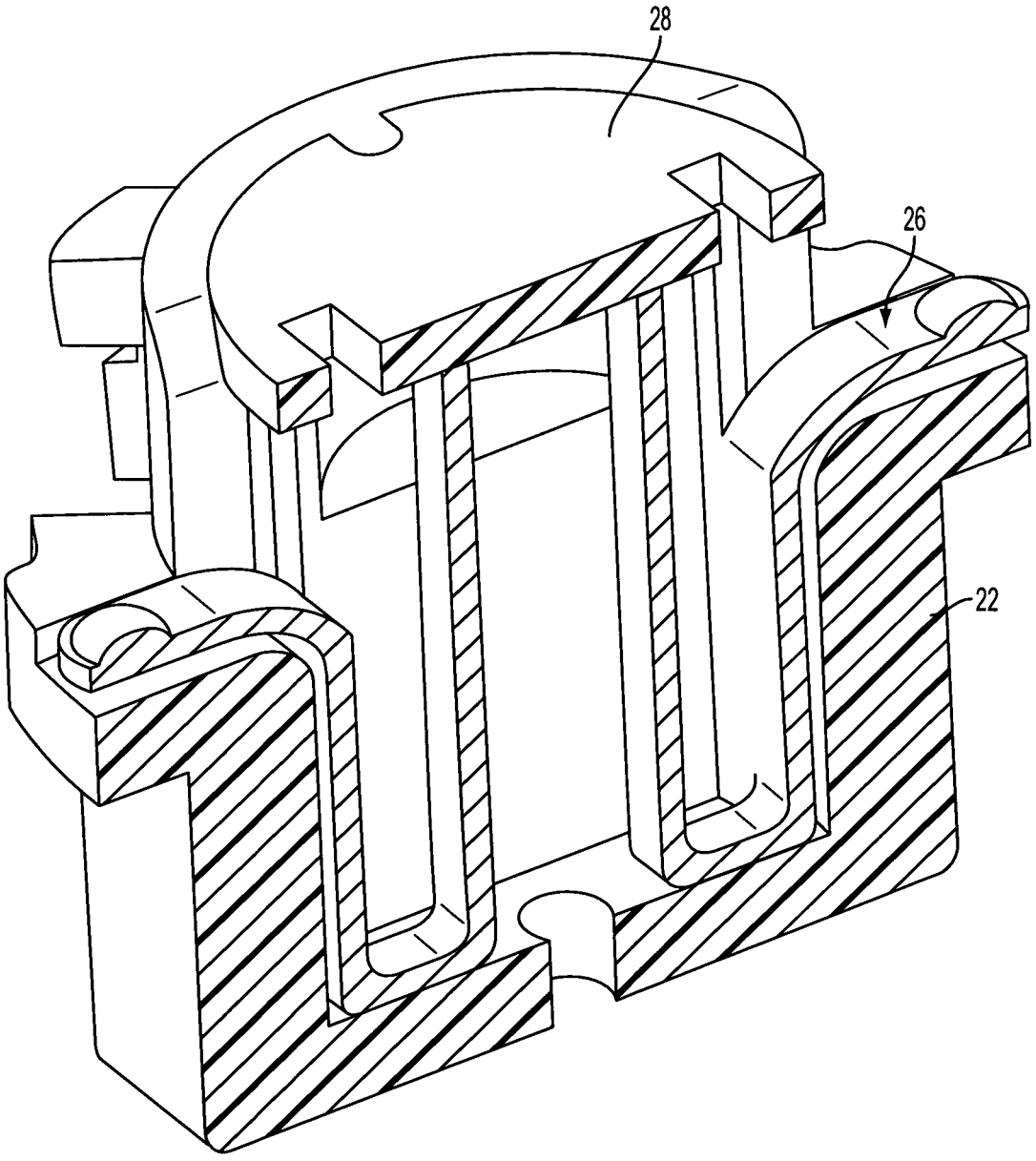


FIG. 6

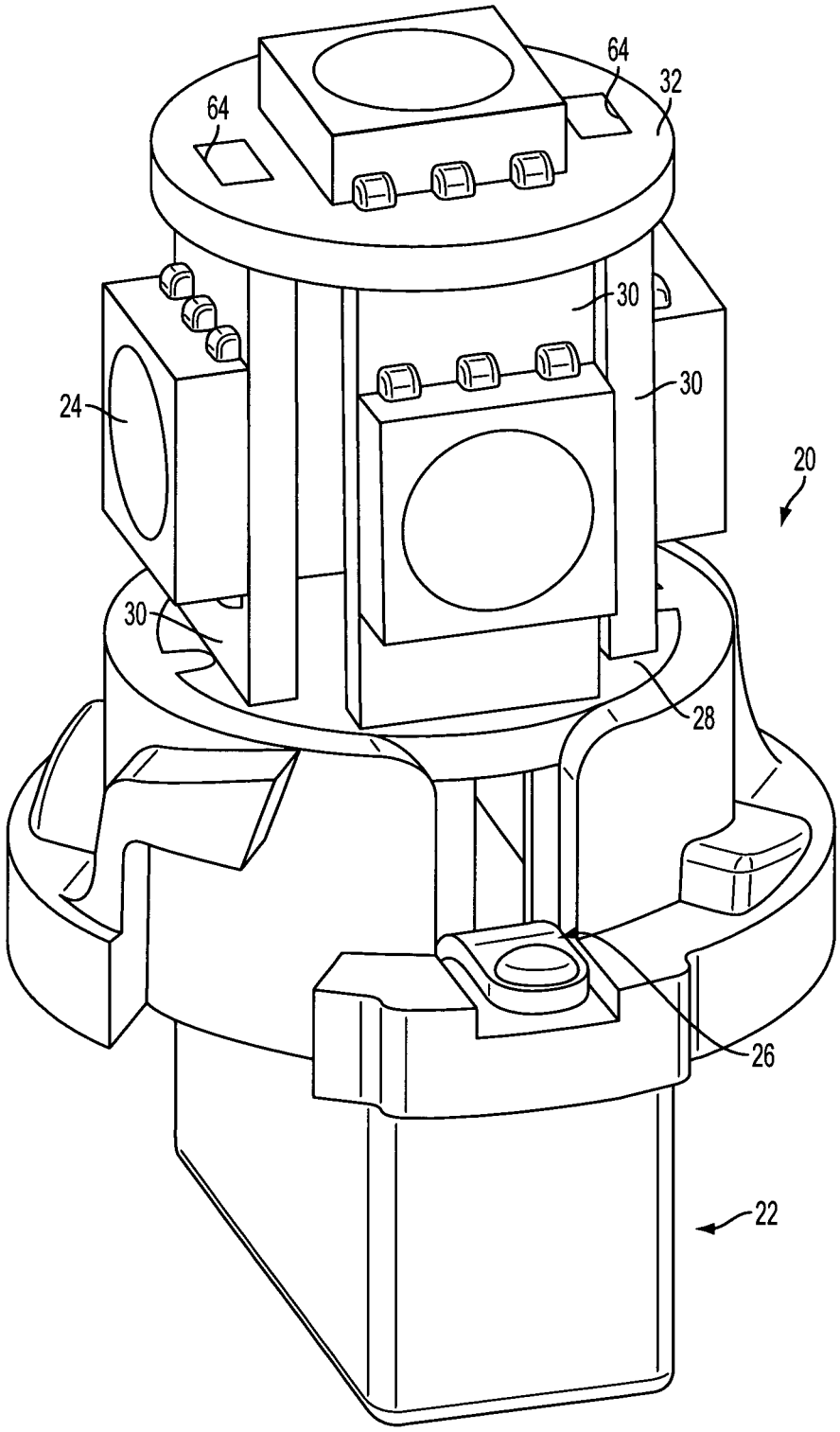


FIG. 7

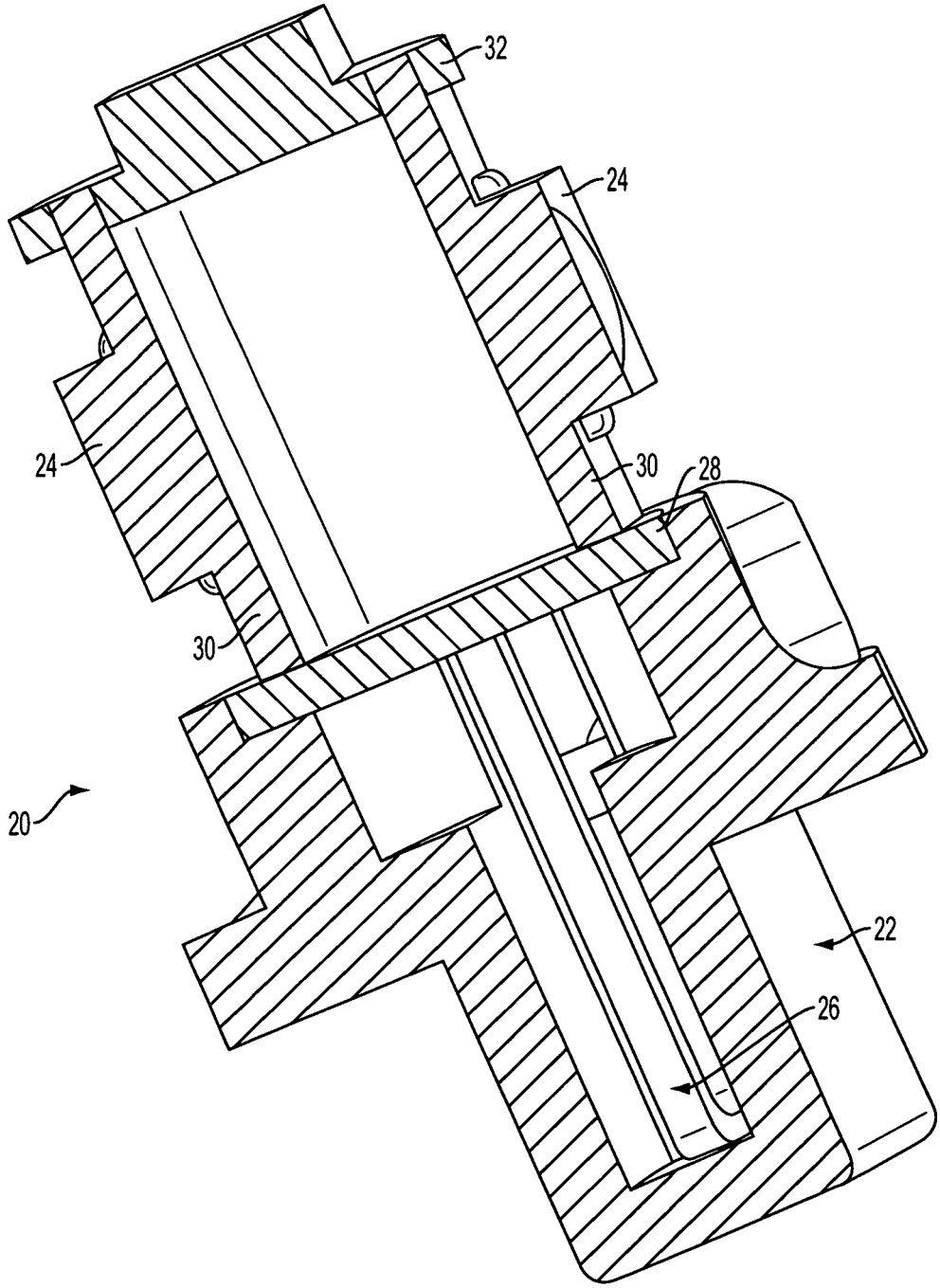


FIG. 8

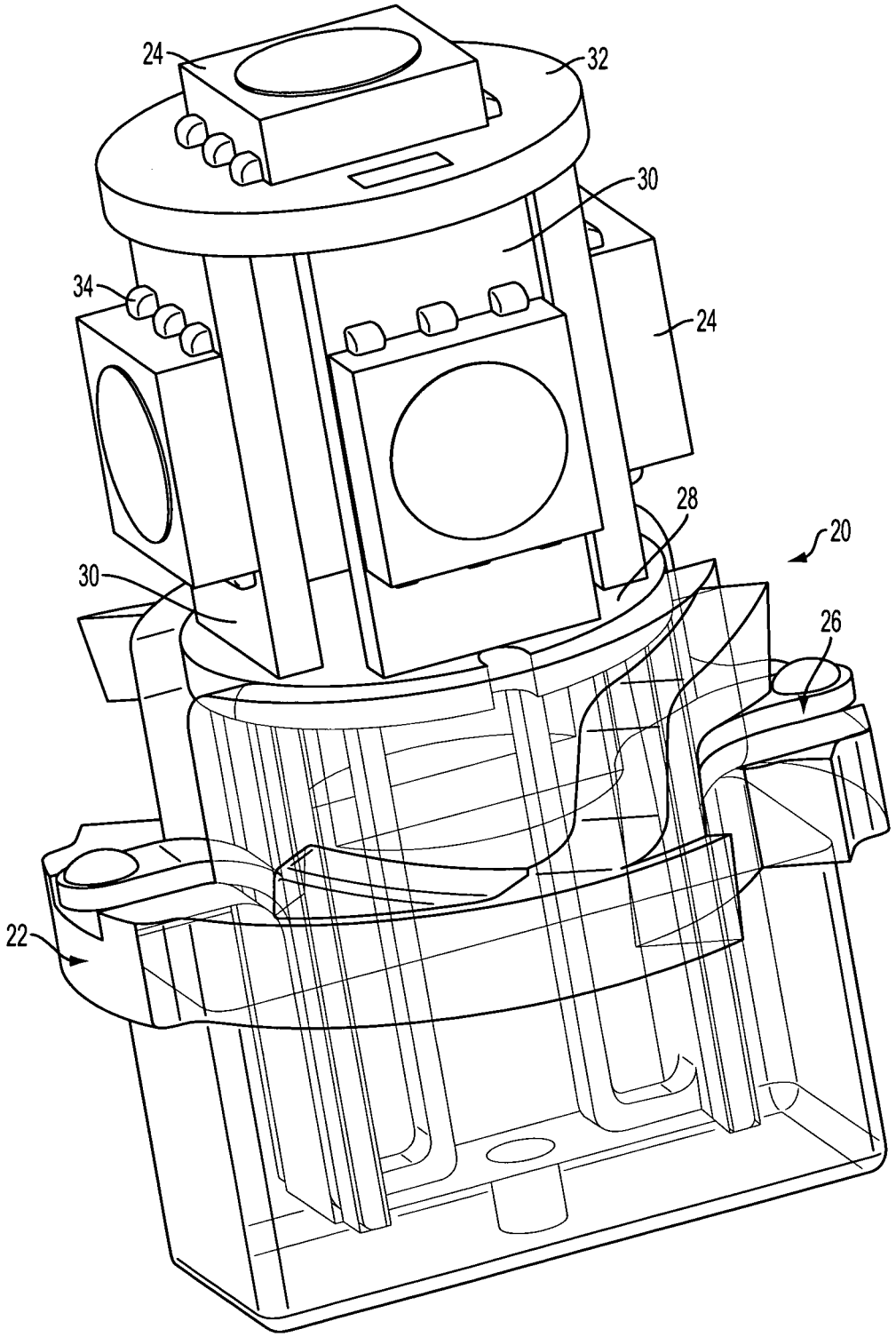


FIG. 9

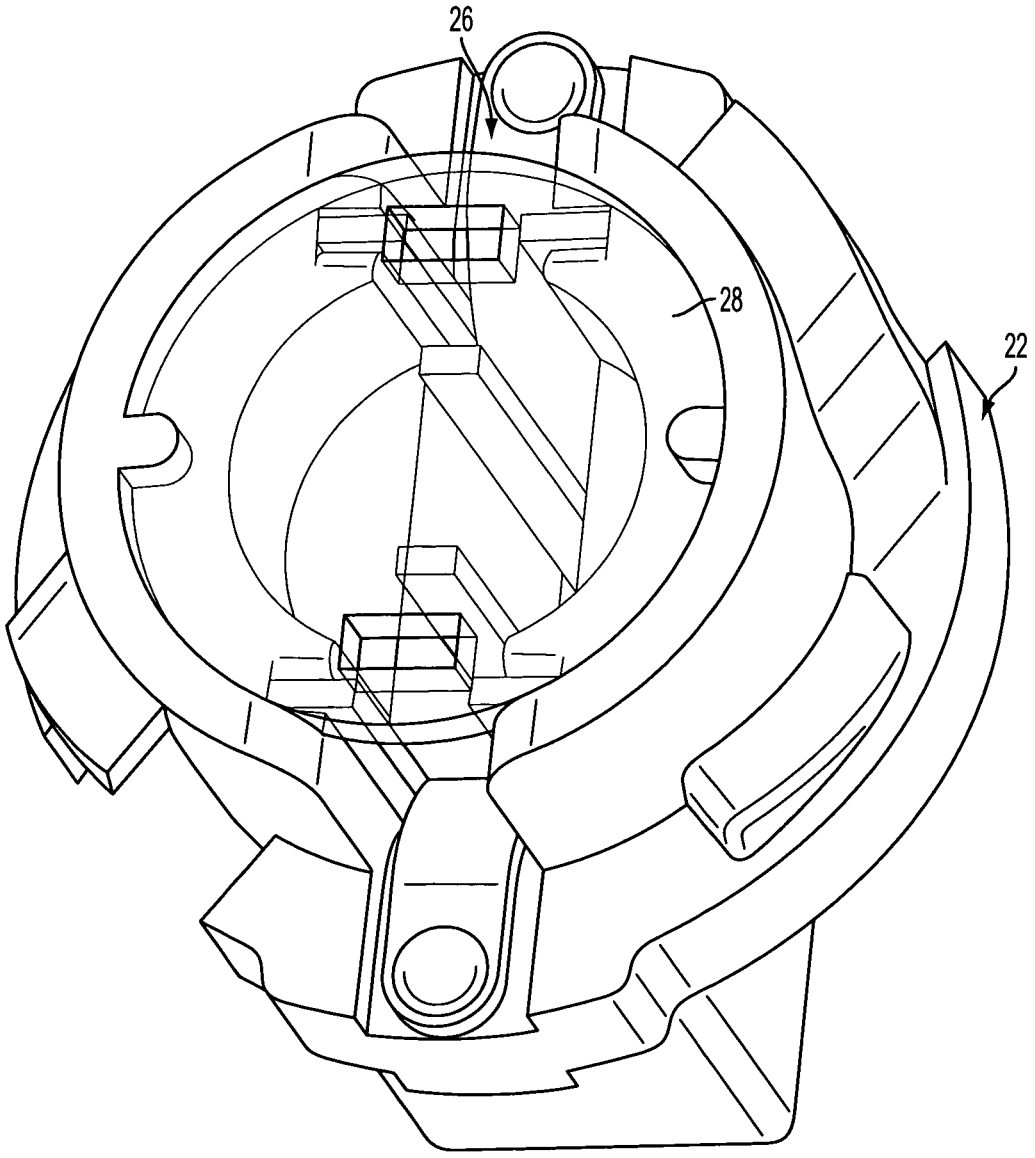


FIG. 10

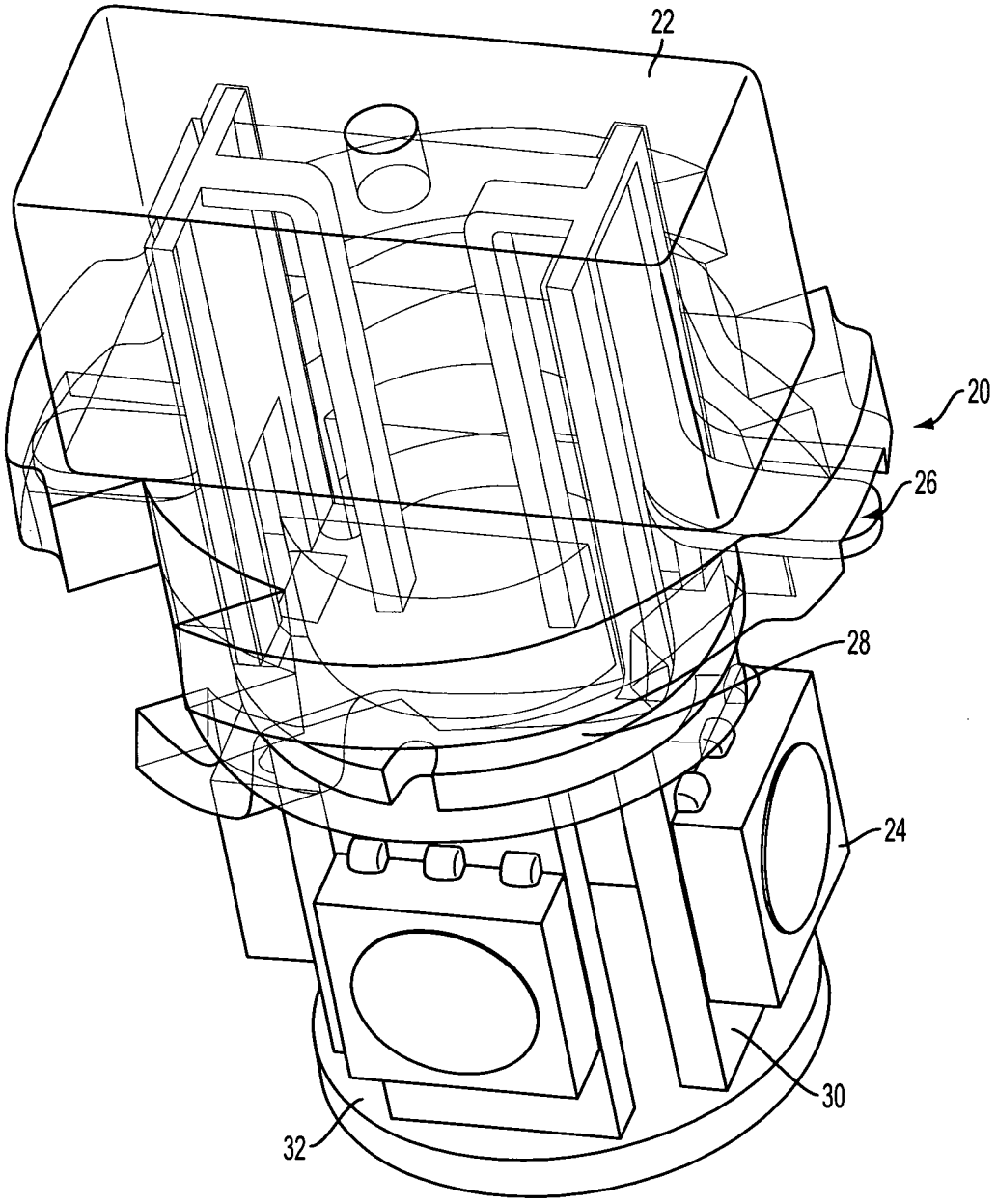


FIG. 11

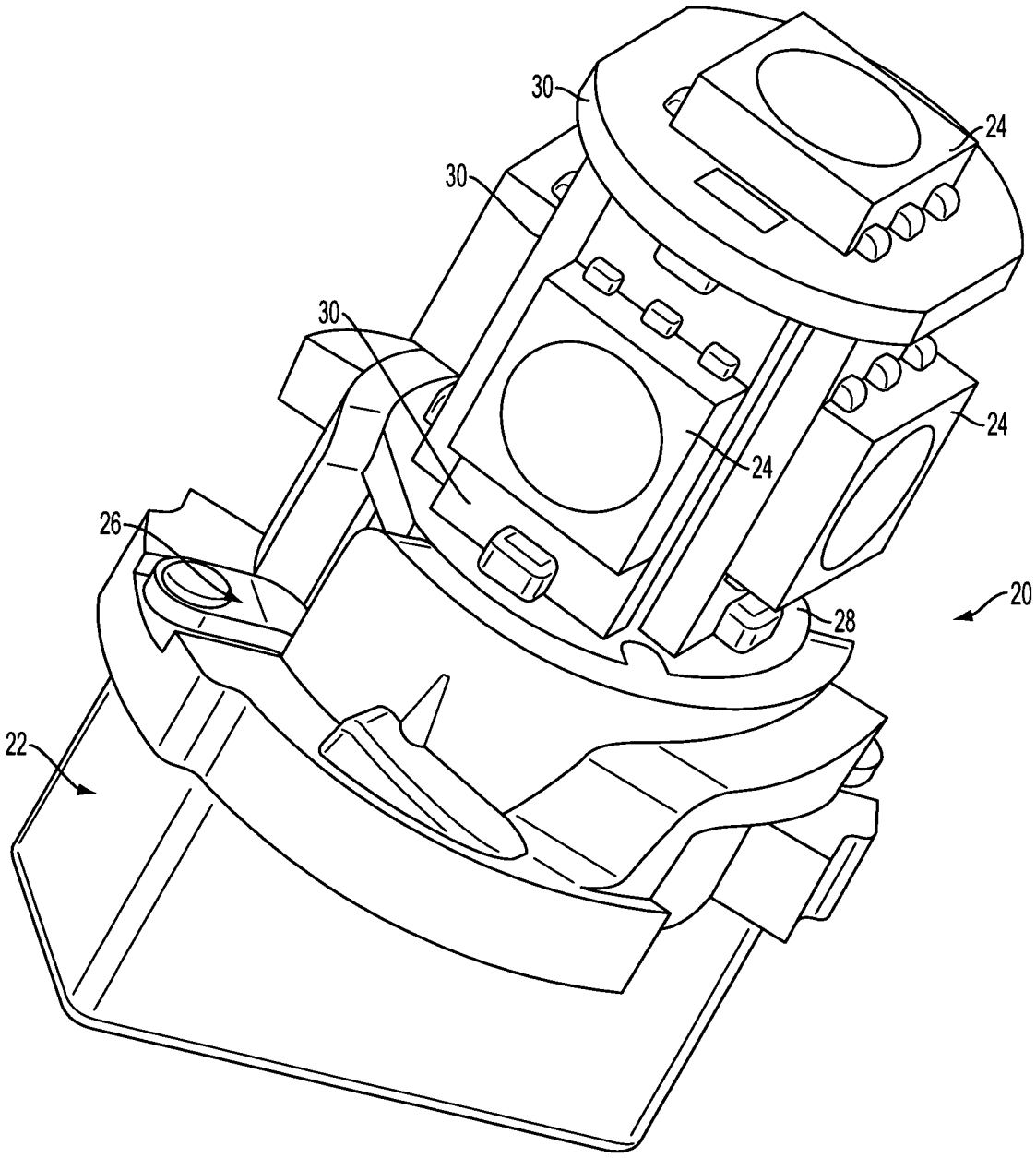


FIG. 12

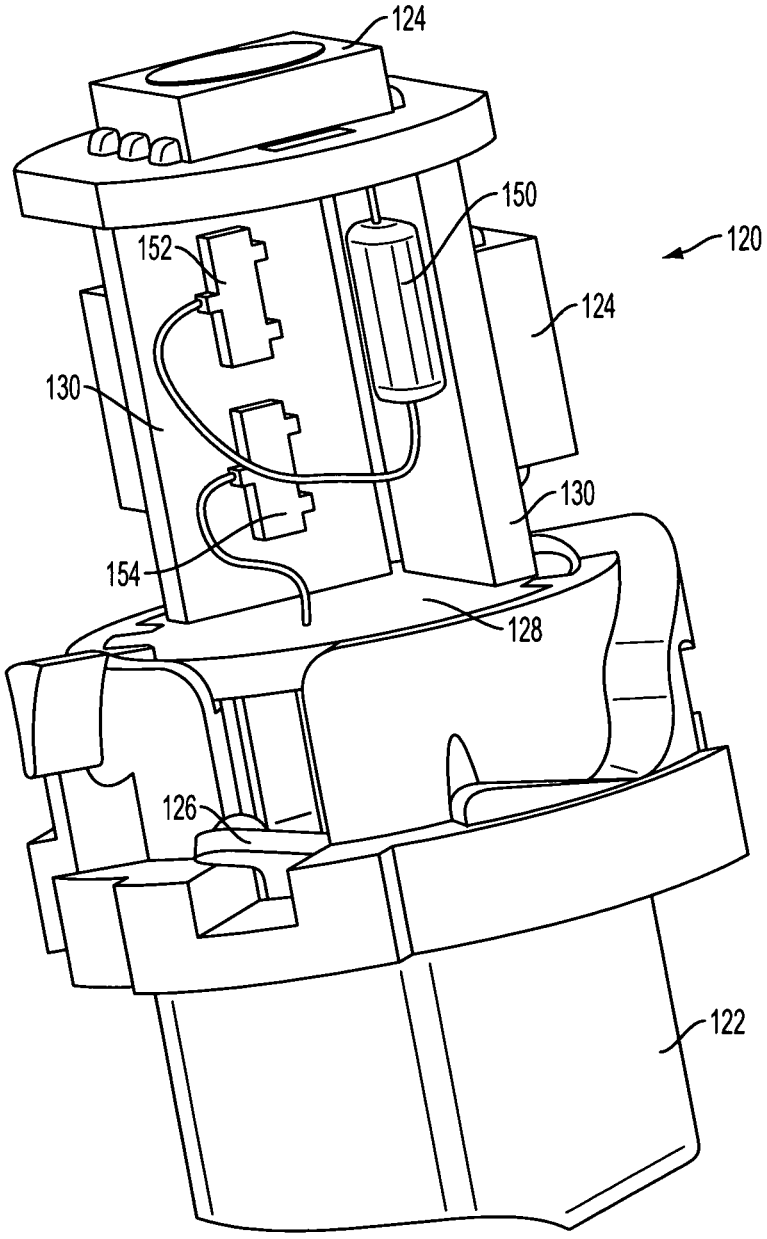


FIG. 13

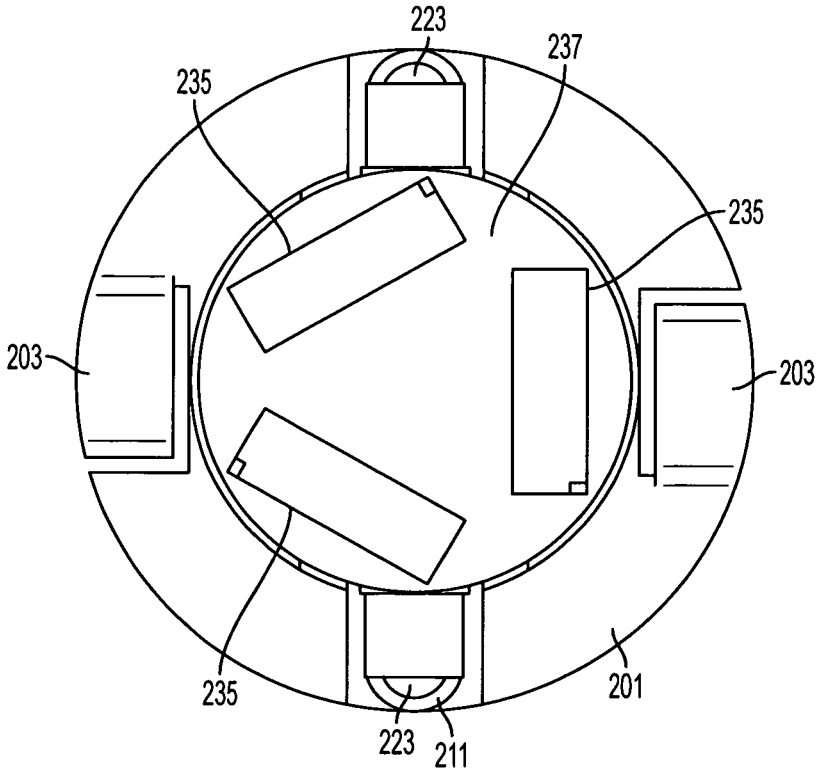


FIG. 14

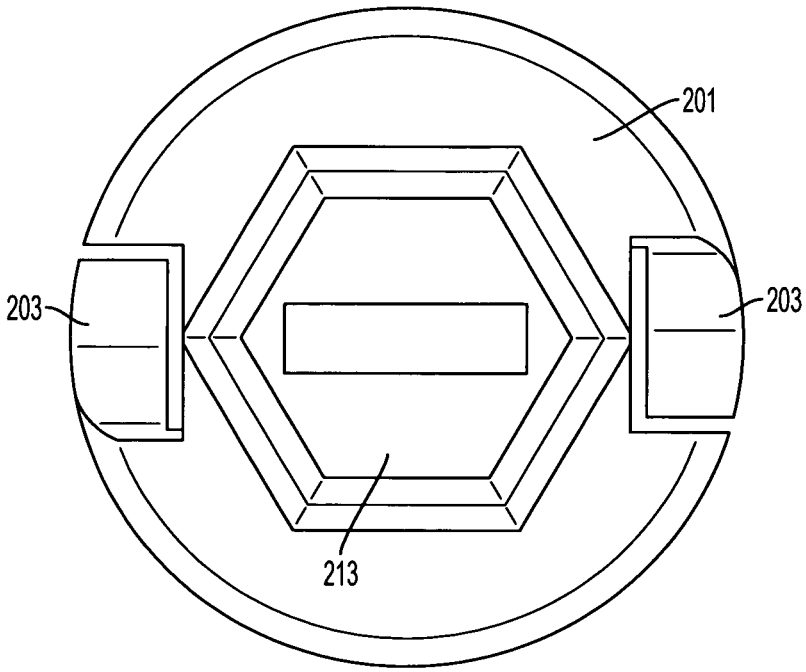


FIG. 15

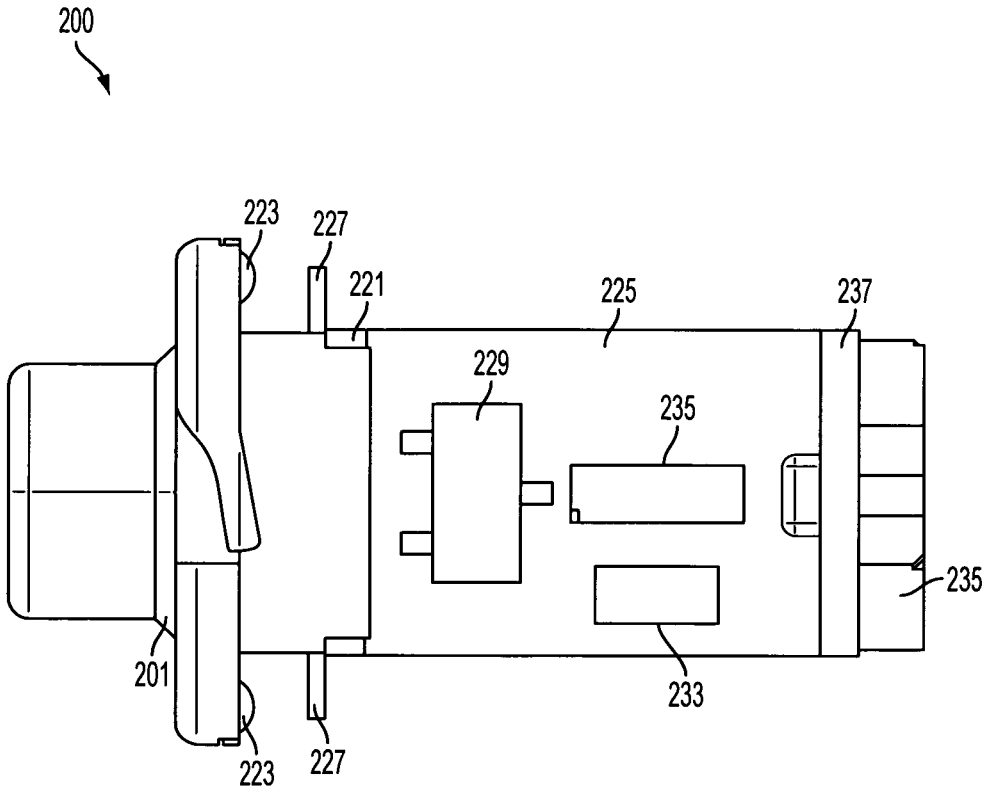


FIG. 16

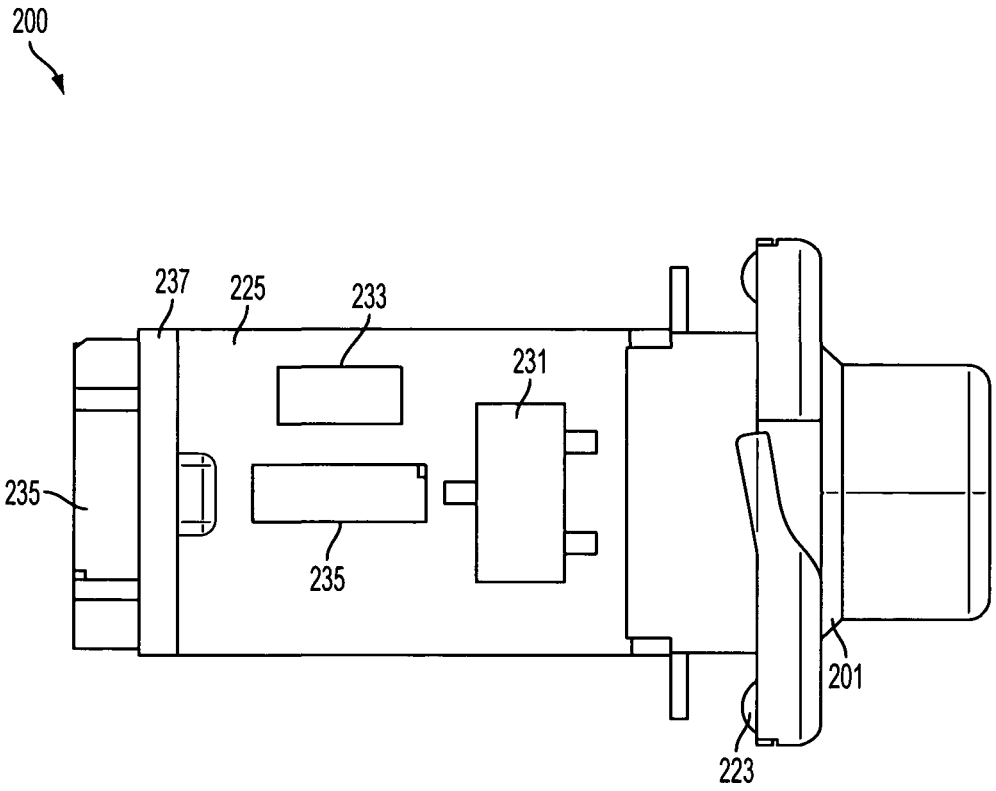


FIG. 17

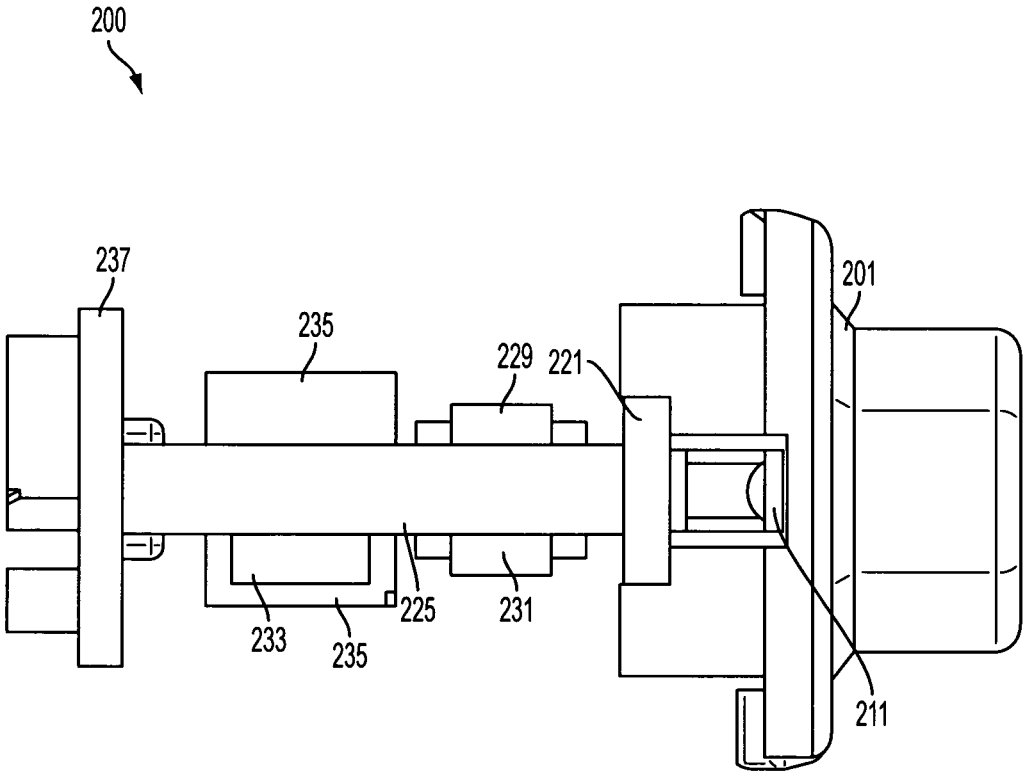


FIG. 18

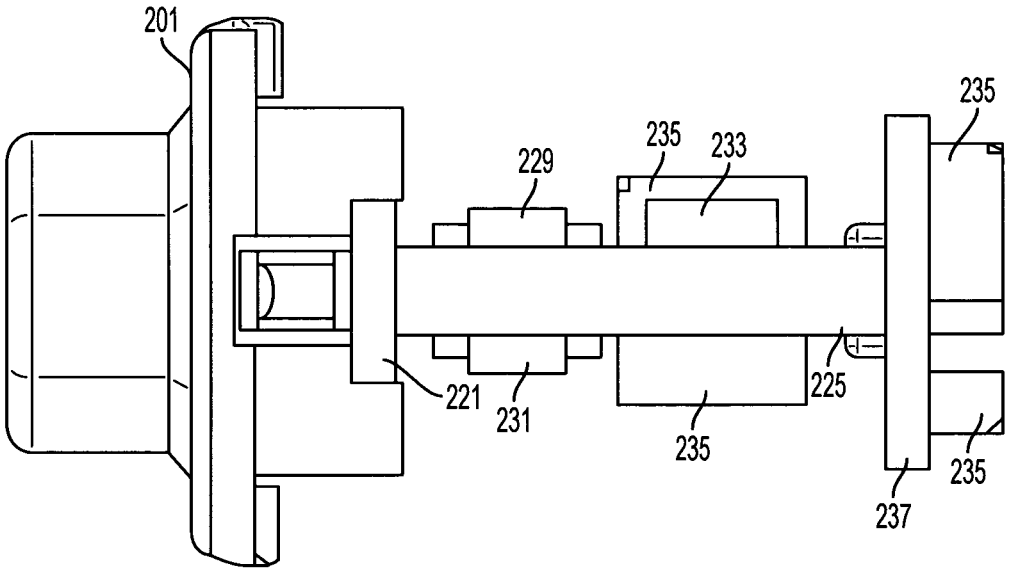


FIG. 19

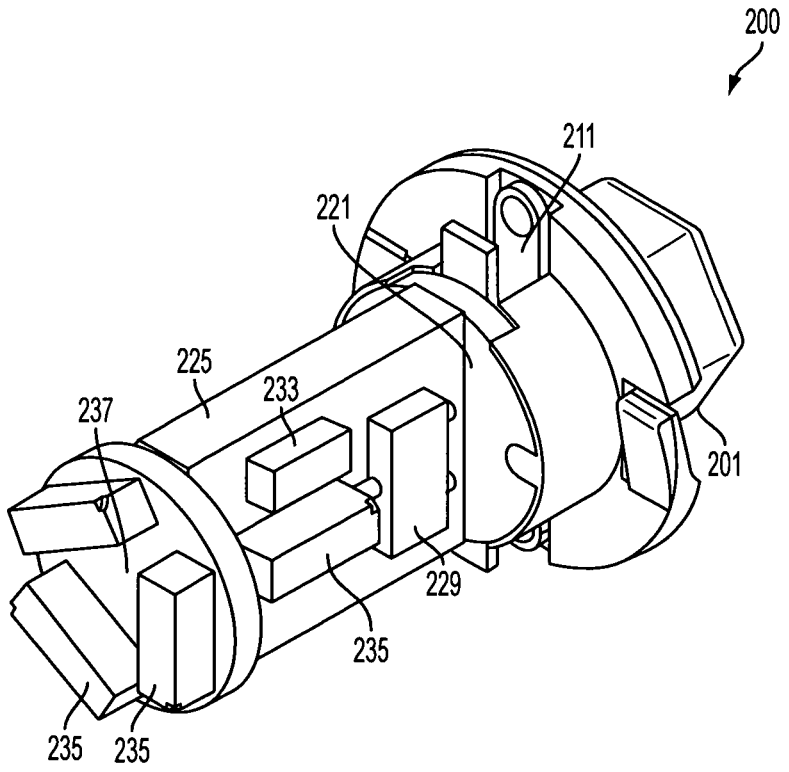


FIG. 20

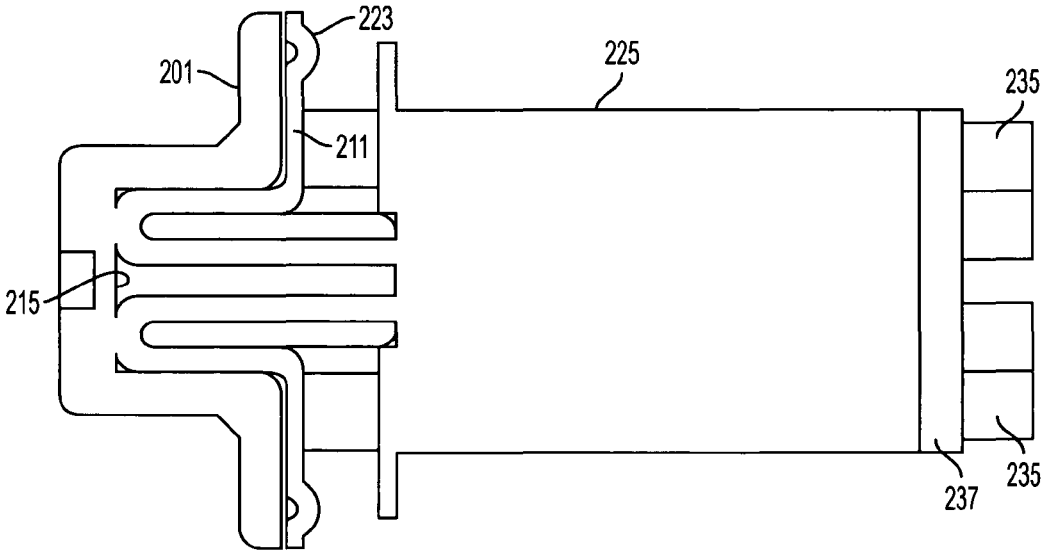


FIG. 21

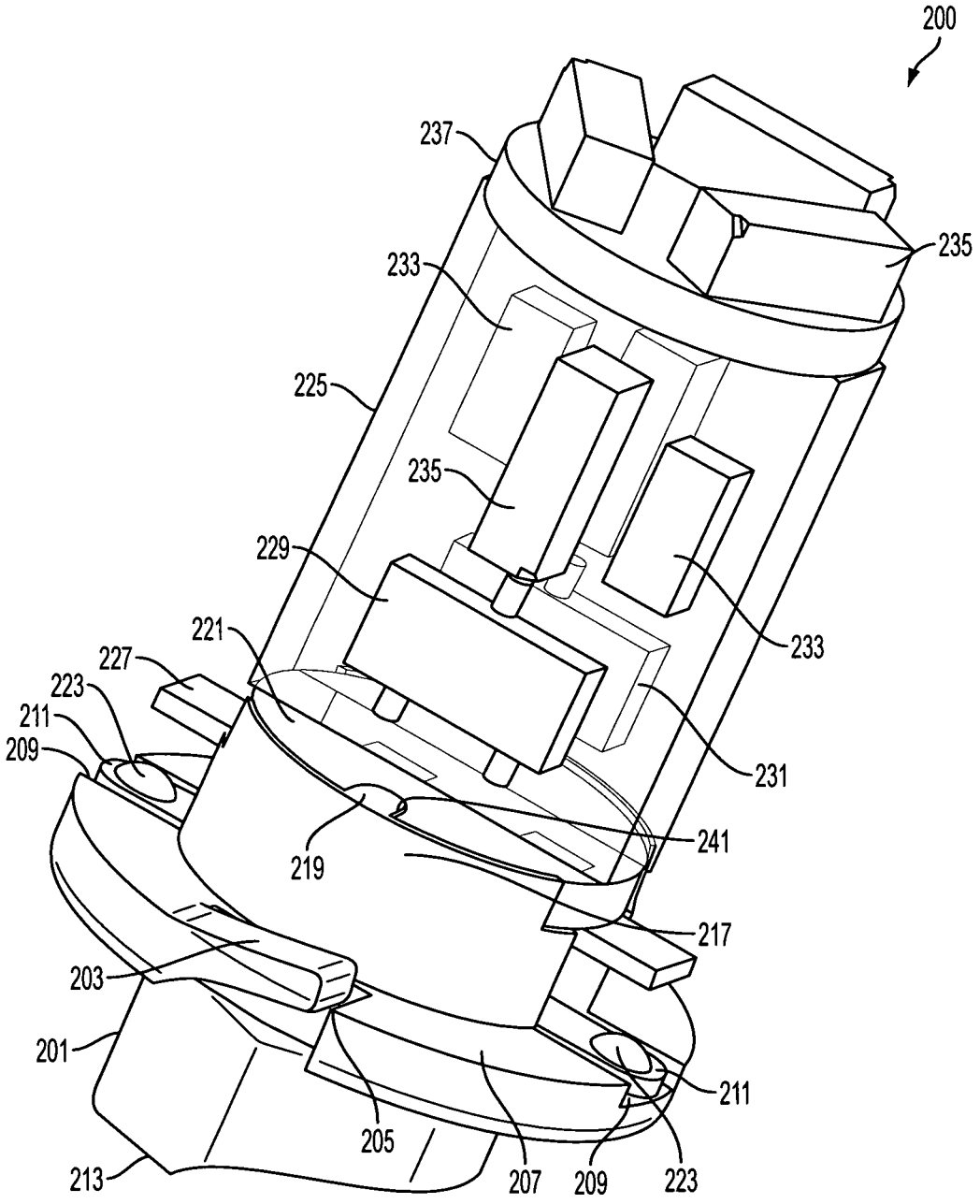

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FIG. 22

LED LIGHTBULB

This application is a continuation in part application of pending U.S. application Ser. No. 14/041,315—Filed on Sep. 30, 2013

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention generally relates to light bulbs and more particularly relates to a LED wedge light bulb system.

2. Description of Related Art

Light bulbs, such as T-10 style light bulbs and LED's, have been well known in the art and available in the market place for quite sometime. Generally, in the prior art, a wedge bulb is only the light bulb portion of a lighting system. Some prior art LED light bulbs require a base to mount to a circuit board in order to emit light in a predetermined direction and color. Generally, these prior art LED bulb bases are a twist in style base with metal connectors, which carry the current to the light bulb for use in lighting the LED style light bulb. It should be noted that these prior art T-10 wedge light bulbs generally have low power consumption and ultra long life and may be used in any known lighting application, but generally are used for replacement of turn signal lights, corner lights, parking lights, side marker lights, tail lights, backup lights, etc., and may be used in the automotive, marine or aviation vehicle industries. These prior art LED light bulbs may be compatible to numerous socket and bulb models, such as but not limited to T-10, 194, W5W, 147, 152, etc. It should be noted that generally these wedge style prior art LED light bulbs use SMD panels or surface mounted devices to form the light bulbs. These surface mounted devices (SMD) generally have pixels that consist of red, green and blue diodes mounted into a single package, which is then mounted on a driver PC board. It should be noted that the individual diodes in some prior art LED bulbs are smaller than a pin head and are set very close together. It should also be noted that conventional or discrete LED's may also be used in prior art LED bulb technologies.

Therefore, there is a need in the art for an improved LED SMD light bulb system. There also is a need in the art for an LED SMD light bulb system that is easier to connect to the lighting system. There also is a need in the art for a more reliable LED SMD style light bulb that may assure proper alignment between metal contactors and the circuit boards, components, or receptacles carrying the LEDs. There also is a need in the art for a more robust LED SMD light bulb system that may not vibrate out of a wedge base during use in a vehicle. There also is a need in the art for a one piece design or system for a LED light bulb and base integrated with one another.

SUMMARY OF THE INVENTION

One object of the present invention may be to provide an improved LED light bulb system.

Another object of the present invention may be to provide an improved LED SMD light bulb that is integrated with a socket base.

Still another object of the present invention may be to provide an LED light bulb system that removes and/or reduces connection issues between a light bulb and the base into which the light bulb is arranged.

Still another object of the present invention may be to provide an LED light bulb system that ensures the metal contacts are aligned correctly and touching to ensure maximum efficient operability of the LED light bulb.

Still another object of the present invention may be to provide an LED light bulb system that may not vibrate out of a wedge base thus allowing for a more complete and robust LED light bulb.

Still another object of the present invention may be to provide an LED light bulb system that creates a novel one piece design between a light bulb and a socket base, thus creating a more robust and efficient LED light bulb for use in various applications.

Still another object of the present invention may be to provide an LED light bulb system that reduces the cost and man hours necessary to replace and visually verify the light bulbs are working by creating a combination socket base and light bulb into one integral unit.

Another object of the present invention may be to provide an LED SMD light bulb system that is capable of being used as replacements for turn signal lights, corner lights, parking lights, side marker lights, tail lights, backup lights, and any other light bulb which currently uses a T-10 bulb in any known vehicle, such as automotive, marine, and aeronautical vehicles.

To achieve the foregoing objects and other advantages, a light bulb for use in numerous lighting applications comprises a socket base and a contactor arranged in the socket base. The light bulb also comprises a support circuit board secured to the socket base and a plurality of circuit boards connected to the support circuit board. The light bulb also comprises at least one resistor mounted on each of the plurality of circuit boards.

One advantage of the present invention may be that it provides a novel and improved LED light bulb.

Still another advantage of the present invention may be that it provides a novel and improved LED SMD light bulb system for use in numerous lighting applications.

Yet another advantage of the present invention may be that it provides an LED light bulb system that has a socket base integral with a light bulb thus reducing any connection issues between the light bulb and its associated base.

Still another advantage of the present invention may be that it provides an LED light bulb system that has metal contactors that are properly aligned and correctly touching at all times between the base and the light bulb thus ensuring the light may work in a more efficient and stable manner.

Yet another advantage of the present invention may be that it provides for an LED light bulb system that is resistant to vibration out of the socket into which the LED light bulb is arranged, thus allowing for more uniform and robust light emission from that of prior art LED light bulbs.

Still another advantage of the present invention may be that it provides for a LED light bulb system that integrates into one design both a base socket and a LED light bulb.

Still another advantage of the present invention may be that it provides for an LED light bulb system that reduces the cost of making the light bulb, replacing the light bulb and ensuring the light bulb is working properly.

Other objects, features and advantages of the present invention may become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a socket base according to the present invention.

FIG. **2** is a perspective view of a socket base and a contactor according to the present invention.

FIG. **3** is a cross sectional view of a socket base and contactor according to the present invention.

FIG. **4** is a plan view of a contactor and LED light bulb according to the present invention.

FIG. **5** is a perspective view of a contactor and a support circuit board according to the present invention.

FIG. **6** is a cross sectional view of a socket base, support circuit board and contactor according to the present invention.

FIG. **7** is a side view of an LED light bulb system according to the present invention.

FIG. **8** is a cross sectional view of an LED light bulb system according to the present invention.

FIG. **9** is a partial cross sectional view of an LED light bulb system according to the present invention.

FIG. **10** is a top view of a socket base, support circuit board and contactor according to the present invention.

FIG. **11** is a bottom perspective view of an LED light bulb system according to the present invention.

FIG. **12** is a perspective view of an LED light bulb system according to the present invention.

FIG. **13** is a partial perspective view of an LED light bulb system according to an alternate embodiment of the present invention.

FIG. **14** is a top view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **15** is a bottom view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **16** is a front view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **17** is a back view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **18** is a side view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **19** is a side view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **20** is a perspective view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **21** is a cross sectional view of an alternate embodiment of an LED light bulb system according to the present invention.

FIG. **22** is a perspective view of an alternate embodiment of an LED light bulb system according to the present invention.

DESCRIPTION OF THE EMBODIMENT(S)

Referring to the drawings, a light emitting diode (LED) light bulb system **20** is disclosed. Light emitting diodes have been known for years for use in light bulbs, flat panel displays and the like. Generally, there are two different types of LED light bulbs, one is a conventional LED light bulb, which uses discrete LED's, the other is a surface mounted device (SMD) panel. The surface mounted device panel generally has an SMD pixel that consists of red, green and blue diodes mounted in a single package, which is then mounted on a driver PC board, receptacle, component, device, or other circuit board. It should be noted that LED light bulbs may be made to replace any known incandescent or CFL light bulbs and in particular are now being used in vehicular applications for both the automotive, marine and aeronautical vehicle industries. Some of these applications create original or replacement bulbs for turn signal lights, corner lights, parking lights, side marker lights, tail lights, back up lights, etc. Generally, many of these bulbs for vehicular applications are referred to as a T-10 type light bulb. Most of the prior art LED replaceable T-10 light bulbs are actually the light bulb itself that are plugged into a socket that is then arranged into a vehicular system to provide the necessary light needed in the vehicle. The present invention is an improved LED light bulb system **20** that integrates a socket base **22** with an LED light bulb to create a more efficient and robust LED SMD light bulb system **20** for use in vehicular applications and in particular, T-10 light bulb designs. However, it should be noted that the design of the socket base **22** integrated with a high out put SMD LED **24** light bulb may be used and converted into any known light bulb in any known industry.

The LED light bulb system **20** of the present invention as shown in FIGS. **1** through **12** generally include a twist in socket that may lock onto a circuit board for a lighting application. The LED light bulb system **20** of the present invention also may include a contactor **26** which may contact with leads on a circuit board to carry or transfer power to the LED's **24** of the light bulb. The LED light bulb system **20** of the present invention may also include a base or support circuit board **28** mounted in contact with the metal contactors **26** to support a plurality of vertically mounted circuit boards **30** that contain LED's **24** thereon. The vertically mounted circuit boards **30** each have at least one LED SMD **24** arranged thereon and are mounted to a top surface of the support circuit board **28** to form generally a square shape for the finished light bulb. It should be noted that each of the LED's **24** on the circuit boards **30** are generally high output SMD LEDs **24**. It is also contemplated in the present invention to create and use an additional or top circuit board **32** added to the top of the plurality of circuit boards **30** to allow for an LED **24** to shine vertically away from the socket base **22**. It should further be noted that with the present invention each of the circuit boards **30**, **32** generally may have at least one resistor **34** arranged thereon in order to reduce the DC current provided in the socket base **22** to the contactor **26** down from its twelve volts to the required power voltage needed to light each LED **24** on the circuit boards **30**, **32**.

The socket base **22** of the LED light bulb system **20** of the present invention generally is made of a plastic material. However, it should be noted that any other material may be used for the socket base **22** and any other component of the LED light bulb system **20** including but not limited to any known metal, ceramic, composite, plastic, natural material, etc. Generally, the socket base **22** is a twist in socket base **22** that has a plurality of ramps and locking shoulders **36** arranged on a collar **38** of the socket base **20** that may allow for it to mate with and interact with a reciprocal socket or component arranged on a circuit board or any other known device of a vehicle or other component. Generally, the twist in socket base **22** of the present invention may be a locking base that via the ramps and locking shoulders **36** arranged on a collar **28** of the socket base **22** may interact with reciprocal shoulders and locking ramps of the final destination circuit board or component to create a lock fit between the socket base **22** and the component to which the LED light bulb system **20** is arranged. It should be noted that generally the LED light bulb system **20** of the present invention may be locked in place by rotating the socket base **22** in a clock wise direction or vice versa. To undo or remove the LED light bulb system **20**, the socket base **20** may be pushed inward and then rotated in a counter clock wise direction or just rotated in a counter clock wise direction to become disengaged from the component or circuit board to which the LED light bulb system **20** is being used. One end of the socket base **22** generally has a rectangular shaped knob **40** that may be used for gripping and rotating the socket base **22** into its appropriate reciprocal. The socket base **22** also may include a generally rectangular shaped groove **42** along a center line or mid point thereof. At least one contactor **26** is arranged within this groove **42**. The locking base **22** of the present invention may

also include a plurality of locking slots **44** arranged near the end corners of the groove **42** of the socket base **22**. These locking slots **44** generally have a square or rectangular like shape and extend vertically down into the socket base **22**. In one contemplated embodiment as shown in FIG. **1**, a total of four locking slots **44** are arranged near the ends of the groove **42** of the socket base **22**. The locking slots **44** generally are arranged across from one another on opposite ends of the groove **42**. The locking base **22** also on one end opposite of the knob **40** like end may include a generally circumferential lip **46**. This circumferential lip **46** generally is divided into two generally half circle arcs with the groove **42** arranged therebetween. The circumferential lip **46** generally defines a circumferential notch **48** for the end of the socket base **22**. The circumferential lip **46** may also include a tab **50** extending radially inward therefrom. Generally, in one contemplated embodiment, two tabs **50** are arranged 180° from one another one on each half of the circumferential lip **46**. These tabs **50** may be used to interact with the support circuit board **28** to secure and align the support circuit board **26** to the socket base **22**. It should be noted that it is contemplated to have no tabs or more than the two tabs **50** as described above arranged from the lip **46** of the socket base **22**.

The LED light bulb system **20** also may include a contactor **26** generally made of a metal material. The contactor **26** may also be made of any known electrically conductive material, such as any known ceramic, composite, plastic, or natural material that is electrically conductive and capable of passing electricity therethrough. Generally, in the LED light bulb system **20** of the present invention a first and second contactor **26** may be arranged within the groove **42** and locking slots **44** of the socket base **22**. The contactors **26** may generally have a body and three legs **52** extending from the body of the contactor **26**. The contactor **26** may also have an arm **54** extending at a generally 90° or right angle from the body at a predetermined point thereof. The arm **54** of the contactor **26** may engage with an end portion of the groove **42** of the socket base **22**. It should be noted that on a top surface of each of the arms **54** of the contactor **26** may generally be a raised bump or mound **56** that may ensure proper contact between the electrical power source and the LED light bulb system **20**. One of the legs **52** of the contactor **26** may extend out at a generally right angle from a bottom portion of the body of the contactor **26** and then extend and turn at another generally 90° angle towards the top of the contactor **26** until an end thereof is in a similar plane as the end of the two other legs **52** which extend directly from the body of the contactor **26**. Thus, the three legs **52** of the contactor **26** may all be parallel to one another in a predetermined pattern when viewed from above. The ends of the legs **52** of the contactors **26** may engage and contact a support circuit board **28** arranged in the socket base **22** of the present invention. This may allow for power to be passed from the arms **54** of the contactors **26** through the legs **52** of the contactors **26** directly to the support circuit board **28** and then onto the circuit boards **30**, **32** holding the LED SMD high output lights **24**. It should be noted that it is also contemplated to create one contactor, which generally has a U-shape instead of two separate contactors for the present invention. It is contemplated to use a press fit to secure the contactors **26** within the locking slots **44** and groove **42** of the socket base **22**. However, any other connecting means, either mechanical or chemical, may also be used including but not limited to gluing, welding, etc.

The support circuit board **28** of the present invention generally has a disc like shape. The support circuit board **28** may include a first and second notch **58** arranged 180° from one another on an outside surface thereof. In one contemplated embodiment the notch may be in a generally semi circular shape, such that it interacts with and interengages with the semi circular shaped tabs **50** arranged on the lip **46** of the socket base **22**. This may ensure that the support circuit board **28** is rotatably fixed, aligned and secured within the socket base **22** at a predetermined position and without the possibility of being vibrated loose. It should be noted that any known securing technique may be used to secure the support circuit board **28** to the socket base **22** such as any known mechanical or chemical fastening technique, such as gluing, press fit, snap lock, etc. Proper replacement of the support circuit board **28** within the socket base **22** may ensure electrical contact is made between the arms **54** of the contactors **26** and the electrical circuit of the support circuit board **28**. This may allow power to flow through the support circuit board **28** to the additional circuit boards **30**, **32** attached thereto. The support circuit board **28** may have a predetermined diameter and thickness that generally mimics that of the lip **46** of the socket base **22**. The circuit boards **28**, **30**, **32** may be made of any known material, such as silicone, etc. or any other known material used for circuit boards. In one contemplated embodiment, the support circuit board **28** may include at least one orifice **60** arranged through a surface thereof. In one contemplated embodiment, a first and second orifice **60** generally having a rectangular shape and arranged at predetermined locations from one another may be arranged through a surface thereof. The orifices **60** on one contemplated embodiment may be located 180° from one another and may be arranged a predetermined distance from the outer edge of the support circuit board **28**. These orifices **60** may be used to receive a tab extending from a circuit board **30** that may be arranged on a top surface of the support circuit board **28**. This may allow for a more robust connection between the circuit boards **30** having the LED's **24** arranged thereon and the support circuit board **28** of the LED light bulb system **20** according to the present invention. It should be noted that generally the support circuit board **28** has a circular or disc like shape, however any other shape may be used for the support circuit board **28** depending on the design and environment in which the LED light bulb system **20** may be used. It should further be noted that the notches on the support circuit board **28** and the orifices through the support circuit board **28** may be of any known shape other than those shapes described above and shown in the drawings.

The LED light bulb system **20** also may include a plurality of circuit boards **30** connected and arranged on a top surface of the support circuit board **28** according to the present invention. Generally, in one contemplated embodiment, the plurality of circuit boards **30** includes four circuit boards **30** that generally make a square shape for the LED light bulb portion of the LED light bulb system **20** according to the present invention. The circuit boards **30** may be arranged such that the LED SMD **24** is arranged and facing in an outward direction thus able to shine light in a complete 360° radius from the light bulb system **20**. The LED SMD **24** may have any known shape such as but not limited to square, circular, triangular, random, etc. Generally, the four circuit boards **30** may be rectangular in shape however any other shape such as a square, circular, triangular, random, etc., may also be used for the circuit boards **30** according to the present invention. In one contemplated embodiment at least two of the circuit boards **30** may include a tab **62** extending from an end surface thereof, wherein the tabs **62** may interact with the orifices **60** and the support circuit board **28** to provide a more robust connection between the circuit boards **30** and the support circuit board **28**. Each of the four circuit board **30** may be in contact with a top surface of a support circuit board **28** and

electrically in communication and connected to the support circuit board **28** in order to have power pass from the contactors **26** through the support circuit board **28** into each of the circuit boards **30** and onto each of the SMD LED's **24** of each of the four circuit boards **30** arranged on the top surface of the support circuit board **28**. It is also contemplated to have more than one LED **24** mounted on the surface of the four circuit boards **30**, such that multiple lights and multiple colors may be transmitted and emitted from the LED's **24** to provide for varying light intensities and colors. It should be noted that each of the LED's **24** are electrically connected and in communication with the circuit boards **30** to ensure there is power necessary to light the LED's **24**. It should be noted that generally each of the circuit boards **30** may have at least one resistor **34** and in some cases multiple resistors **34** arranged thereon. These resistors **34** may reduce the DC current from the twelve volts provided to the contactors **26** of the socket base **22**, to the required power voltage necessary to light and run each of the LED's **24** arranged on the circuit boards **30** of the LED light bulb system **20**. It should further be noted that any other electronic circuitry and soldering necessary to operate the LED's **24** in the appropriate manner for the environment in which the light bulb is used may also be arranged on each of the four circuit boards **30** according to the present invention.

It should also be noted that it is also contemplated to have an additional or fifth or top circuit board **32** connected to or added to the top of the plurality of circuit boards **30** to allow for an LED **24** to shine vertically away from the socket base **22**. This may provide light to be emitted in all directions from the system **20**. In one contemplated embodiment the additional or fifth circuit board **32** generally may have a disc like or circular shape, such as that of the support circuit board **28**. However, it should be noted that any other shaped circuit board may also be used for the firth or top circuit board **32** according to the present invention. This additional top circuit board **32** may have a SMD LED **24** arranged on its outer surface such as those other four circuit boards **30** described above. The fifth or additional circuit board **32** may also include at least one orifice **64** through a surface thereof and in one contemplated embodiment a first and second orifice **64** arranged in a manner similar to the orifices **60** arranged through the support circuit board **28**. Generally, the orifices **64** of the top circuit board **32** may be arranged offset 90° from the orifices **60** through the support circuit board **28** and receive a tab **62** from the end of at least two of the circuit boards **30** arranged on the support circuit board **28**, thus increasing the rigidity and robustness of the LED light bulb system **20** according to the present invention. It should be noted that the top circuit board **32** may be electrically connected to at least one but may be all four of the circuit boards **30** to which it is in contact with. This may allow for the proper voltage to be passed through to the top or fifth circuit board **32** thus allowing for the LED **24** to function properly from that position. It should be noted that the thickness of all of the circuit boards **28**, **30**, **32** generally may be the same, however any known thickness may be used for the circuit boards **28**, **30**, **32** depending on the design and environment in which the LED light bulb system **20** may be used. It should be noted that generally a twelve volt light bulb system **20** has been described herein, however the light bulb system **20** may be used in any other lower voltage or higher voltage environment depending on the design of the LED and power electronic systems. It should be noted that all of the circuit boards generally are made of a silicone material, however any other known material, such as any known plastic, metal, ceramic, composite, or natural material may be used to create the circuit boards and the necessary circuitry thereon.

The LED light bulb system **120** may also include an alternate embodiment, which generally operates and has the same components as that described above. Like numerals indicate like parts. In this alternate embodiment of the LED light bulb system **120** a RC current limiting resistor **150** may be arranged or secured on a surface of at least one of the plurality of circuit boards **130** of the light bulb system **120**. In one contemplated embodiment the current limiting resistor **150** is arranged on an inside surface of the circuit board **130** which is the side opposite the outer side having an LED **124** thereon. The alternate embodiment LED light bulb system **120** may also have arranged on or secured to another of the plurality of circuit boards **130** a common cathode diode **152** which acts as a positive pole for the LED light bulb system **120** and a common anode diode **154** which acts as a negative pole for the LED light bulb system **120**. In one contemplated embodiment the common cathode diode **152** and common anode diode **154** are arranged on an inside surface of the circuit board **130** which is the side opposite the outer side having an LED **124** thereon. It should be noted that any known common cathode diode **152**, common anode diode **154** or RC current limiting resistor **150** may be used depending on the design requirements and environment in which the LED light bulb system **120** may be used. The common cathode diode **152** may be electrically connected to the current limiting resistor **150** by any known means such as but not limited to a wire, solder, etc. The common anode diode **154** may be electrically connected to the support circuit board **128** by any known means. As described above, all of the plurality of circuit boards **130** of the alternate embodiment of the LED light bulb system **120** may be in electrical communication with the metal contactors **126** of the LED light bulb system **120**. It should be noted that as described above, metal contactors **126** may be made of any known metal, however in one contemplated embodiment a conductive copper is used and may allow for conduction to the circuit boards **130** from the metal contactors **126**. The alternate embodiment may also use the same type of LED's **124** as the light source as described above, such as but not limited to a 5050SMD, which is in LED 5050 light source. The use of the common cathode diode **152** and common anode diode **154** along with the RC current limiting resistor **150** in the alternate embodiment may allow for the LED light bulb system **120** to be plugged into a socket in which the light bulb system **120** is arranged in either direction, thus making for an easier installation process for the person installing the light bulb **120** into the socket. Thus, the base **122** may be put into the socket in either or any direction which creates an easier to use part and more efficient part, thus increasing the efficiencies of the manufacturing process. It should be noted that a multitude of common cathode diodes, common anode diodes, and RC current limiting resistors may be used other than that as described above and may be arranged on other circuit board surfaces of the present invention including but not limited to any of the plurality of circuit boards **130** or the support circuit board **128**.

FIGS. **14** through **22** show an alternate embodiment of an LED light bulb system **200** according to the present invention. In the alternate embodiment shown in these figures, the light bulb **200** is what is commonly referred to as a T5 wedge type light bulb for use in numerous lighting applications. Generally, the T5 bulb is a smaller bulb than the T10 wedge style bulb described above. The T5 LED light bulb system **200** may convert standard T5 bulbs using filaments and other electronic technology into an LED based light bulb system **200**. This may allow for more efficient lighting and longer life for

the light bulbs in the lighting application. In one contemplated embodiment, the T5 bulb is used in automotive applications and vehicles throughout a vehicle system. Like numerals indicate like parts. As shown in the figures, the alternate embodiment of the LED light bulb system **200** generally includes a base **201**, which is used to interact with and be located within a socket or receptacle of a vehicle or other component. This may allow for the LED light bulb system **200** to be arranged within a vehicle or other component via the base **201**. The base **201** of the LED light bulb system **200** is generally made of a plastic material. However, it should be noted that any other material may be used for the base **201** and any other component of the LED light bulb system **200** including but not limited to any known metal, ceramic, composite, plastic, natural material, etc. Generally, the base **201** may be a twist in socket base that has at least one locking ramp **203** and locking shoulder **205** arranged thereon. In one contemplated embodiment, a first and second locking ramp **203** may be arranged 180° from one another on a collar **207** of the base **201**. The ramps **203** and locking shoulders **205** may allow for the LED light bulb system **200** to mate with and interact with a receptacle, socket or component arranged on a circuit board, or any other known device of a vehicle or other component. The receptacle or socket into which the base **201** may be arranged generally has complimentary locking surfaces or ramps to interact with the locking shoulders **205** and ramps **203** located on the collar **207** of the base **201** of the present invention. Generally, the LED light bulb system **200** of the present invention may be locked into position by inserting into a socket and twisting in a predetermined direction to engage and lock the locking shoulders **205** and ramps **203** to a reciprocal surface in the socket. However, it is also contemplated to use a push and lock system that may not need twisting of the base **201** once it is arranged within a socket. It should be noted that the rotation of the base **201** in the socket may be in either a clockwise or counter clockwise direction depending on the design of the LED light bulb system **200**. The collar **207** of the base **201** of the present invention generally may have a first and second notch **209** arranged 180° from one another and approximately 90° from the locking shoulders **205** of the collar **207**. The notch **209** may allow for receiving, placing or arrangement therein of a contactor **211**. One end of the base **201** generally may have a predetermined shaped knob that may be used for gripping and rotating the base **201** into its appropriate receptacle or socket. In one contemplated embodiment, the knob **213** generally has six sides to allow for easy gripping by a person inserting the bulb into the appropriate socket. The base **201** may also include a generally rectangular shaped groove **215** along a center line or mid point thereof. At least one contactor **211** is arranged within this groove **215**. The base **201** of the present invention may also include a plurality of locking slots arranged near the end of the corners of the groove of the socket base **201**. The locking slots generally may have a square or rectangular like shape and extend vertically down into the socket base. These locking slots help to secure the contactor **211** within the groove **215** of the base **201**. The base **201** may also include on an end opposite of the knob having a generally circumferential lip **217**. The circumferential lip **217** generally is divided into two generally half circle arcs with the groove **215** arranged therebetween. The circumferential lip **217** forms a circumferential notch for the end of the base **201**. The circumferential lip **217** may also include a tab **219** extending radially inward therefrom. Generally, in one contemplated embodiment, two tabs are arranged 180° from one another on each half of the circumferential lip **217**. The tabs **219** may be used to interact with a support circuit board **221** to secure and align the support circuit board **221** to the base **201**. It should be noted that it is contemplated to have no tabs or more than two tabs as described above arranged from the lip of the base **201**. It should further be noted that the locking ramps and shoulders of the base **201** may also be capable of flexing in a predetermined direction to ensure proper locking of the LED light bulb system **200** into the receiving socket or receptacle. It should be noted that the base **201** may also include a first and second arm **227** extending from an outside surface thereof arranged 180° from one another and generally aligned with the groove **215** along the mid line of the base **201**.

The alternate embodiment of the LED light bulb system **200** may also include a contactor **211** generally made of a metal material. The contactor **211** may be made of any known electrically conductive material, such as any known ceramic, composite, plastic or natural material that is electrically conductive and capable of passing electricity therethrough. In one contemplated embodiment, the contactor **211** may be made of a conductive copper which may be in electrical communication and allow for conduction to occur to the circuit boards arranged on the LED light bulb system **200**. Generally, in the LED light bulb system **200** of the alternate embodiment of the present invention a first and second contactor **211** may be arranged within the groove of the base **201**. The contactor **211** generally has a body and a predetermined number of legs extending from the body of the contactor **211**. The contactor **211** may also have an arm extending at a generally 90° right angle from the body at a predetermined point thereof. The arm of the contactor **211** may engage with an end portion of the groove **215** of the base **201**. It should be noted that on a top surface of each of the arms of the contactor **211** may have a raised bump or mound **223** that may ensure proper contact between the electrical power source and the LED light bulb system **200**. One of the legs of the contactor **211** may extend out at a generally right angle from a bottom portion of the body of the contactor **211** and then extend and turn at another generally 90° angle towards the top of the contactor **211** until an end thereof is in a similar plane as the end of the other two legs which extend directly from the body of the contactor **211**. Thus, the legs of the contactor **211** may all be parallel to one another in a predetermined pattern when viewed from above. The ends of the legs of the contactors **211** may engage and contact the support circuit board **221** arranged in the base **201** of the present invention. This may allow for power to be passed from the arms of the contactors **211** directly to the support circuit board **221** and then onto the other circuit boards and LED lights. It should be noted that it is also contemplated to create one contactor **211** which only has a U-shape instead of two separate contactors **211** as shown in the present invention. It is contemplated to use a press fit to secure the contactors **211** within the locking slots and groove of the base **201**. However, any other connecting means either mechanical or chemical may also be used including but not limited to gluing, welding, soldering, or any other mechanism for holding the contactor **211** within the base **201**.

The LED light bulb system **200** of the alternate embodiment also may include a support circuit board **221** which generally has a disc like shape. The support circuit board **221** may include a first and second notch **241** arranged 180° from one another in an outside surface thereof. In one contemplated embodiment the notch **241** may be in a generally semi circular shape such that it interacts and interengages with the semi circular shaped tabs **219** arranged on the lip **217** of the base **201**. This may ensure that the support circuit board **221** is rotatably fixed, aligned and secured within the base **201** at a predetermined position without the possibility of being

vibrated loose. It should be noted that any known securing technique may be used to secure the support circuit board to the base **201**, such as any known chemical or mechanical fastening technique, such as gluing, press fit, soldering, snap lock, etc. Proper placement of the support circuit board **221** within the base **201** ensures electrical contact is made between the contactor **211** and electrical circuit of the support circuit board **221**. This may allow power to flow through the support circuit board **221** to additional circuit boards attached thereto. It should be noted that the support circuit board **221** may have any known shape other than the generally disc like shape depending on the design and environment in which the LED light bulb system **200** may be used. The support circuit board **221** may have a predetermined diameter and thickness that generally mimics and is about the same as the lip **217** of the base **201**. The support circuit board **221** may be made of any known material, such as silicone or any other known material used for circuit boards. The support circuit board **221** may also include at least one orifice arranged through a surface thereof. In one contemplated embodiment the orifice generally may be used to secure a circuit board thereto that may be arranged on a top surface of the support circuit board **221**. This may allow for a more robust connection between the circuit boards having the LED's arranged thereon and the support circuit board **221** of the LED light bulb system **200**. However, it is also contemplated to use soldering or any other fastening technique to secure the other circuit boards to the support circuit board **221** of the present invention.

The LED light bulb system **200** of the alternate embodiment may also include a first circuit board **225** connected and arranged on a top surface of the support circuit board **221** according to the present invention. Generally, in one contemplated embodiment, the first circuit board **225** includes a circuit board having a generally rectangular shape. However, it should be noted that any other shape may be used for the first circuit board **225** according to the present invention. The first circuit board **225** generally is arranged and connected at one end to the top surface or through the top surface of the support circuit board **221** depending on the design requirements. The first circuit board **225** generally is arranged on a top surface of the support circuit board **221** such that the first circuit board **225** is perpendicular to the support circuit board **221**. The first circuit board **225** is aligned such that it follows along in generally the same plane as the groove **215** formed along a mid line of the base **201**. The first circuit board **225** generally having a rectangular shape has one of its shorter ends secured to the support circuit board **225** via any known mechanical or chemical fastening technique. The width, shape and design of the first circuit board **225** may be different than that of a rectangle as shown in the drawings. The first circuit board **225** may include a common anode diode **229** or negative pole on one surface thereof and a common cathode diode **231** or positive pole on another surface thereof. In one contemplated embodiment the common anode diode **229** is arranged on one side of the first circuit board **225** and the common cathode diode **231** is arranged on the opposite side of the first circuit board **225**. Both the common anode diode **229** and common cathode diode **231** are electrically connected to the circuit creating the power necessary to energize the LED light sources arranged on the circuit boards. At least one RC current limiting resistor **233** is also arranged on the first circuit board **225** and electrically connected with the electric circuit of the LED light bulb system **200** according to the present invention. In one contemplated embodiment, the current limiting resistor **233** is arranged on each side of the first circuit board **225** according to the present invention. It should further be noted that at least one LED light source **235** may be arranged on the first circuit board **225**. In one contemplated embodiment, an LED light source **235** is arranged on each side of the first circuit board **225** to provide proper light emission for the T5 bulb system. In one contemplated embodiment, the LED light source **235** is a 3014 SMD LED light source and is arranged and secured facing in an outward direction on each side of the first circuit board **225** such that it is able to shine light in most all directions from the light bulb system **200**. The LED SMD **235** may have any known shape, such as but not limited to rectangular, as shown in the drawings, square, circular, triangular, any other known or random shape, etc. It should further be noted that it is also contemplated to create an LED light bulb system **200** according to the present invention that does not include the common cathode diode, common anode diode, or the current limiting resistors. Such a LED light bulb system that does not include those components would have to be assured to be properly aligned and placed into the socket or receptacle to allow for proper operating of the LED light sources.

It should also be noted that it is contemplated in the alternate embodiment of the LED light system **200** to have a second circuit board **237** secured to a top end of the first circuit board **225**. This securing of the second circuit board **237** to the first circuit board **225** may allow for electrical communication between the first and second circuit boards and the support circuit board, thus allowing for the LED light bulb system **200** to operate properly. The connection between the second circuit board **237** and the first circuit board **225** may be any known mechanical or chemical fastening technique, such as but not limited to tabs used to secure the boards to one another, or solder being used to secure the boards to one another and any other known chemical or mechanical fastening technique. In one contemplated embodiment, the second circuit board **237** may generally have a circular disc like shape that mimics that of the support circuit board **221**. However, any other shape may be used for the second circuit board **237** depending on the design requirements and environment in which the LED light bulb system **200** may be used. Generally, the second circuit board **237** may include at least one LED light source **235** on a top surface thereof that may allow for light to be shined in a vertical direction away from the base **201**. This may provide light to be emitted in all directions from the LED light bulb system **200**. It should be noted that any other shape circuit board may also be used for the second circuit board **237** according to the present invention. In one contemplated embodiment the second circuit board **237** may have multiple SMD LED **235** arranged in a predetermined pattern on its outer surface such that there are three LED light sources **235** arranged in a generally triangular pattern when viewed from above on the top surface of the second circuit board **237**. However, any number of SMD LED **235** may be secured to the top surface of the second circuit board **237** by soldering or any other known methodology and electrically connected to the electric circuit of the LED light bulb system **200**. It should also be known that the thickness of all of the circuit boards generally may be the same, however any known thickness may be used for the circuit boards depending on the design and environment in which the LED light bulb system **200** may be used. It should further be noted that generally the circuit boards are designed the same as those embodiments described above and the methodology of connecting and fastening the circuit boards to one another and to the base generally may be the same as the embodiments described above.

The present invention has been described in an illustrative manner. It is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than that of limitation.

Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A light bulb, said bulb comprising:

a base, said base having at least one ramp on a surface thereof;

a contactor arranged in said base;

a support circuit board secured to said base;

a first circuit board connected to said support circuit board on one end thereof, said first circuit board in a same plane as said contactor; and

a second circuit board connected to said first circuit board, said second circuit board is parallel to said support circuit board.

2. A light bulb, said bulb comprising:

a base, said base having a groove along a centerline thereof;

a contactor arranged in said base;

a support circuit board secured to said base;

a first circuit board connected to said support circuit board on one end thereof, said first circuit board in a same plane as said contactor; and

a second circuit board connected to said first circuit board, said second circuit board is parallel to said support circuit board.

3. A light bulb, said bulb comprising:

a base, said base having at least one tab extending radially inward from a top edge thereof;

a contactor arranged in said base;

a support circuit board secured to said base;

a first circuit board connected to said support circuit board on one end thereof, said first circuit board in a same plane as said contactor; and

a second circuit board connected to said first circuit board, said second circuit board is parallel to said support circuit board.

4. The bulb of claim **1** wherein said base having at least one locking member extending from a surface thereof.

5. The bulb of claim **1** wherein said contactor is made of copper.

6. The bulb of claim **1** wherein said contactor having a bump or raised surface.

7. The bulb of claim **1** wherein said contactor is electrically connected to said support circuit board.

8. The bulb of claim **1** wherein said support circuit board has a generally disc like shape.

9. The bulb of claim **1** wherein said support circuit board is secured in a circumferential notch of said base.

10. The bulb of claim **1** wherein said first circuit board having a generally rectangular shape.

11. The bulb of claim **1** wherein said first circuit board having at least one light emitting diode arranged on a surface thereof.

12. The bulb of claim **1** wherein said first circuit board having a current limiting resistor arranged on a surface thereof.

13. The bulb of claim **1** wherein said first circuit board having a common cathode diode and a common anode diode arranged thereon.

14. The bulb of claim **1** wherein said second circuit board having a generally disc like shape.

15. The bulb of claim **1** wherein said second circuit board having at least one light emitting diode arranged on a surface thereof.

16. A light emitting diode system for use in lighting applications, said system comprising:

a base;

an electrically conductive contactor secured to said base;

a support circuit board secured to said base and electrically connected to said contactor;

a first circuit board arranged on a surface of said support circuit board, said first circuit board is perpendicular to said support circuit board, said first circuit board having a current limiting resistor, said first circuit board having a common cathode diode and a common anode diode, said common cathode diode, said common anode diode and said current limiting resistor allow for said base to be plugged into a socket in either direction;

a second circuit board connected to said first circuit board, said second circuit board is parallel to said support circuit board; and

a light emitting diode secured to said first circuit board and said second circuit board.

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